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REDUCING OF INDUSTRIAL ATMOSPHERIC EMISSIONS USING ELECTROCYCLONE

A. Titov,[1] J. Shrimpton,[2] I. Kovalev,[1] Cheng Shao,[3] Zhuohan Li[3]

[1]Ural Federal University, 19 Mira St, Ekaterinburg, 620002, Russia;
[2]University of Southampton, University Road, Southampton, SO17 1BJ, UK;
[3]Dalian University of Technology, No. 2 Linggong Road, Ganjingzi District, Dalian City, Liaoning Province, 116024, P. R. C. E-mail: a.g.titov@urfu.ru

Abstract. The Urals is an industrially developed region of the Russian Federation. More than 1,500 enterprises representing the mining, metallurgical, energy and other industries are found in the Urals. This neighbourhood cannot but affect the environment [1]. The Urals is one of Russia's leading regions in terms of environmental pollution (including air emissions) [2]. Electrocyclone is a combined dust collector that combines the centrifugal and electrostatic effects for aerosol cleaning [3]. The diagram of it is shown in Figure 1. An electrocyclone consists of a body 1, snails with an inlet 2, the central tube 3, a corona system 4, an exhaust pipe 5 and a hopper 6.

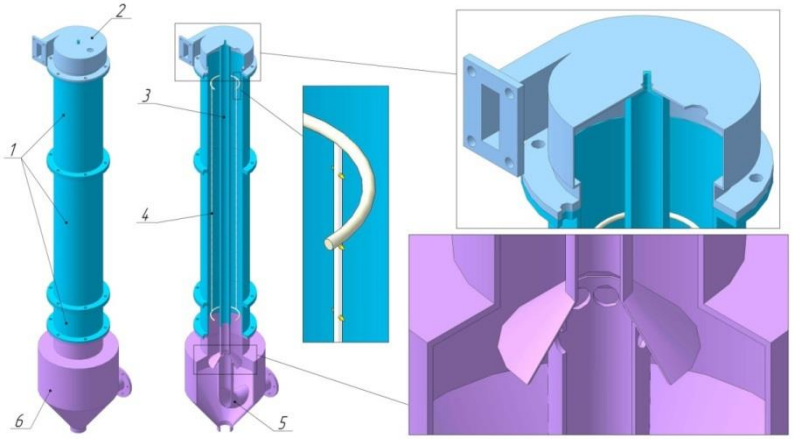

Figure 1. Electrocyclone (model ECV)

Studies have been held to capture the dispersed industrial materials. It is shown that an electrocyclone can be used like existing gas treatment units. For example, in catching sodium percarbonate, the efficiency reached 97.5–99.9%. The iron-vanadium concentrate collection efficiency was up to 98–99.9%. The ash of TPP can be caught with an efficiency up to 99.9%. The optimum operating flow rate of aerosol at the inlet to electrocyclone lies in the range 15–17 m/s. In capturing the fumes of the copper-smelting furnaces some satisfactory data were received (the efficiency does not exceed 50–60%). This can be explained by the high dispersion and adhesion. The factors have led to the termination of electrical purification. In general, the electrocyclone can reduce aerosol emissions from industrial plants into the atmosphere by a few digits to several tens of times. In each case, before choosing an electrocyclone as a gas treatment unit, individual characteristics of the material should be evaluated.

References

1. F. Bréchignac Equidosimetry: Ecological Standardization and Equidosimetry for Radioecology and Environmental Ecology / F. Bréchignac, G. Desmet. – Springer Science & Business Media, 2005. – 436 p.
2. I. Linkov Air Pollution in the Ural Mountains: Environmental, Health and Policy Aspects / I. Linkov, R. Wilson. – Springer Science & Business Media, 2012. – 455 p.
3. 3D Modeling of Electrocyclones with Various Flow Swirling Devices / A. G. Titov, J. Shrimpton // Chemical and Petroleum Engineering. – 2020. – Vol. 55. – P. 876–883.

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